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FOREST PEST MANAGEMENT

BIOLOGICAL EVALUATION R2-81-6

AN EVALUATION TO DETERMINE THE
SUSCEPTIBILITY OF LODGEPOLE PINE TO
MOUNTAIN PINE BEETLE INFESTATION IN
THE DUNOIR SPECIAL MANAGEMENT UNIT

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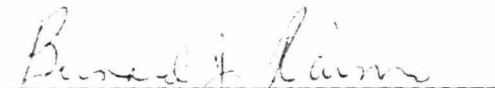
Forest Pest Management
Denver, Colorado

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THE DUNOIR SPECIAL MANANAGEMENT UNIT

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INTRODUCTION

In 1972, Congress passed the Washakie Wilderness Act which combined the Stratified Primitive Area with the South Absaroka Wilderness to create the Washakie Wilderness Area. At that time controversy arose as to whether to include or exclude 28,800 acres of the Upper DuNoir Creek Basin. As a result of the controversy, Congress established the 28,800 acre DuNoir Special Management Unit (SMU) under Public Law 92-476. This law stated that the Secretary of Agriculture will initiate a continuing study of the Unit and at the end of the five year period following the enactment of the Act, a proposal regarding the future designation of this area will be delivered to Congress.

Currently, small isolated patches of lodgepole pine mortality caused by the mountain pine beetle (MPB) exist within the boundary of the SMU. In addition, a MPB outbreak is now underway in lodgepole stands just south of the unit and to the west of DuNoir Creek (Fig. 1).

The Forest Supervisor's concerns over the MPB infestation within stands immediately adjacent to the SMU prompted a request for the Forest Pest Management staff to conduct a survey of the area to determine the probable course of the infestations. The susceptibility to loss by the MPB of the lodgepole type in the DuNoir Creek Basin was determined using a risk-rating scheme designed by Amman et al (1977).

DESCRIPTION OF AREA

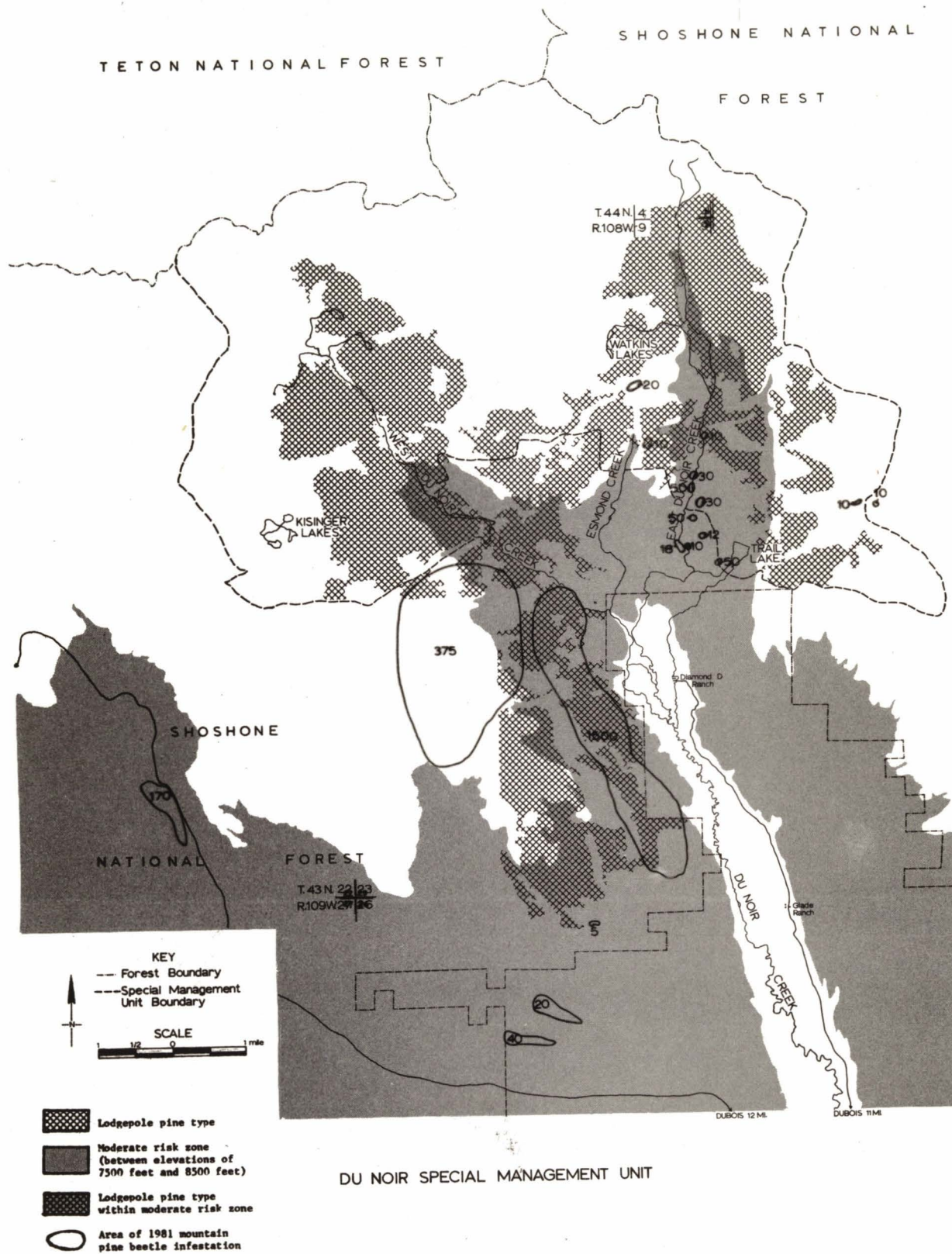
The DuNoir SMU is located at the headwaters of DuNoir Creek on the Wind River Ranger District of the Shoshone National Forest about 25 miles northeast of Dubois, Wyoming (Fig 1). The Unit comprises 28,800 acres.

The area is characterized by vertical cliffs and irregular terrain. The general aspect of the SMU is south with east and west slopes in the northern boundaries. The elevations range between 8,000 and 11,000 feet.

About 80% (21,000 acres) of the Unit is forested with overmature and pole-sized timber. Tree species include subalpine fir, Engelmann spruce, lodgepole pine, whitebark pine, limber pine and Douglas-fir. The remaining 20% of the area is occupied by open parks lakes, ponds and rock cliffs.

Large areas of even-aged forest cover suggest a few very large fires occurred in the Unit about 1840 (USDA For. Serv. undated). From 1921-1929, trees on 11,000 acres of the Unit were cut (about 30-40% of the trees in the Unit). Commercial cutting has not occurred in the Unit since 1930 (USDA For. Serv. undated).

An intensive survey of the timber resource was conducted in 1973 and 1974. In lodgepole pine and spruce-fir types the average site index (at age 100) is 80 bf/ac/yr. Most mortality is due to old age, insects, dwarf mistletoe and comandra rust (USDA For. Serv. undated).



AREAS OF PINE MORTALITY DUE TO MOUNTAIN PINE BEETLE.

BIOLOGICAL INFORMATION

The mountain pine beetle, *Dendroctonus ponderosae* Hopkins, remains the most destructive forest insect pest in the Rocky Mountain Region. Its range comprises the western United States, western Canada and northern Mexico. In the western United States the beetle's preferred hosts are ponderosa, lodgepole and limber pines.

In this Region, the beetle has one generation per year and may overwinter as larvae or adults. Shortly after attacking a host tree, adults excavate vertical egg galleries through the inner bark. Eggs are deposited alternately along the sides of the gallery during its construction. Shortly after oviposition the eggs hatch and larvae excavate short galleries perpendicular to the egg gallery. When fully grown, larvae construct a pupal chamber where pupation occurs. Adult beetles emerge and fly to new host trees from the beginning of July through August.

In addition to girdling the tree, the beetle acts as a vector of blue staining fungi (*Ceratocystis* spp.). Mycelia of these fungi plug the water conducting vessels of the host tree and play some role in causing rapid foliage death.

In lodgepole pine, beetle populations periodically reach epidemic levels and kill most of the larger diameter trees before the beetle population subsides. Factors influencing the frequency and intensity of beetle populations and resultant tree losses include age, diameter distribution, phloem thickness, distribution and elevation and latitude of the stand (Amman et al. 1977).

PROCEDURES

During July and August 1981, aerial detection surveys were conducted to determine precise locations of current lodgepole mortality caused by the MPB. In September, many of the areas where beetle caused mortality was occurring, both within and adjacent to the SMU, were visited.

Transect lines one chain wide and five chains long were run in four cardinal directions from the center of the beetle-killed groups of trees. The number of newly infested trees and trees infested the previous year were tallied in each transect line and attack ratios were determined. Where the lodgepole mortality existed over a large area and was evenly distributed, transect lines were run five chains apart within the infested area.

Attack ratios serve as an indicator as to whether a MPB population is static, declining, or increasing. Attack ratios of 1:1 (trees attacked the previous year : newly infested trees) indicate a static population, ratios of 1:>1 indicate a building population and ratios of 1:<1 indicate declining populations.

Once attack ratios of several of the infested areas were determined, several stand parameters were studied to determine the susceptibility to loss by MPB of several of the lodgepole stands within and adjacent to the SMU. These parameters are described by Amman et al. (1977) and include elevation, latitude, stand age, and average d.b.h.

According to Amman et al., 1977, in order to be susceptible to a beetle epidemic, a lodgepole pine stand must be at an elevation low enough to have a climate optimal for MPB brood survival. The model for determining if a stand lies within a zone of potentially heavy, moderate or light risk is presented in Fig. 2.

Even if a lodgepole pine is in an elevation zone of potentially high susceptibility, the stand must meet other requirements for the beetle to be successful. In general, the stand age must be 80 years or more and the average d.b.h. of a stand for trees 5 inches and larger must exceed 8 inches.

Following Amman's model, by multiplying the following risk factors from Table 1 (1 = low; 2 = moderate; 3 = high) for elevation and latitude, average age and average d.b.h., the stand susceptibility classification is obtained; low = 1 to 9; moderate = 12 to 18; high = 27.

<u>Elevation- latitude</u>	<u>Risk Factor</u>	<u>Average age Years</u>	<u>Risk Factor</u>	<u>Average d.b.h. (inches)</u>	<u>Risk Factor</u>
High (<7500')	(1)	60	(1)	<7	(1)
Moderate (7500' - 8500')	(2)	60-80	(2)	7-8	(2)
Low (<8500')	(3)	>80	(3)	>8	(3)

Table 1. ^{1/}

For example, when risk factors for a high elevation stand (risk of 1) more than 80 years old (risk of 3) with an average d.b.h. of 9 inches (risk of 3) are multiplied ($1 \times 3 \times 3 = 9$), the stand has a low index for beetle infestation because of its elevation.

For our evaluation, the average d.b.h. and average ages of a sample of lodgepole stands within and adjacent to the SMU were obtained from the 1973 and 1974 Stage II data from the area.

^{1/} Amman et al. 1977. Guidelines for reducing losses of lodgepole pine to the mountain pine beetle in unmanaged stands in the Rocky Mountains.

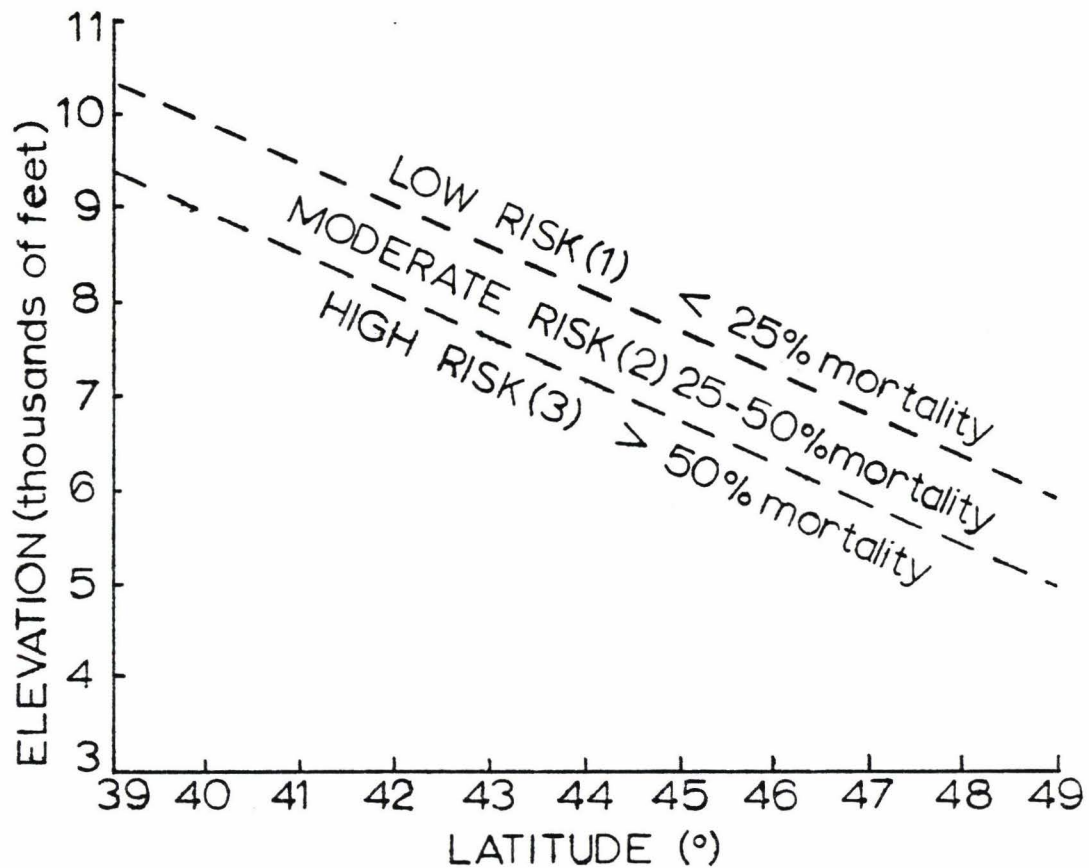


Figure 2. Risk of mountain pine beetle infestation in lodgepole pine can be defined by zones of elevation and latitude. Percent mortality is for trees 8.5 inches d.b.h. and larger. ^{2/}

^{2/} Amman et al. 1977. Guidelines for reducing losses of lodgepole pine to the mountain pine beetle in unmanaged stands in the Rocky Mountains.

RESULTS AND CONCLUSION

Although several isolated groups of lodgepole mortality caused by the MPB exist within the SMU, most of the beetle attacks have been in limber pine. Very little lodgepole pine occurs adjacent to these limber pine stands. Consequently, there is little MPB activity in lodgepole associated with these infestations.

Attack ratios within the SMU indicate that the MPB population is currently increasing (average ratio = 1:2.14). Ratios within the large infested area west of DuNoir creek outside the SMU (Fig. 1) also indicate increasing beetle populations (average ratio = 1:2.74). However, because of the high elevational location of the lodgepole pine throughout the DuNoir Creek Basin, none of the timber lies within the high risk zone (below 7500') and of the 8500 acres of lodgepole type within the SMU, 1250 acres lies in the moderate risk zone (between 7500' and 8500') (Fig. 1).

The largest area of moderate risk lodgepole within the SMU occurs in the DuNoir Creek drainage (Fig. 1). Stand data indicates that the average d.b.h. of the lodgepole in this area is about 9 inches and the average age of the stands is about 160 years. Using the susceptibility table of Amman et al. (Table 1), we find that the susceptibility index is 18 ($2 \times 3 \times 3$), solidly placing these stands into the moderate risk category.

A MPB problem does not currently exist within the SMU but there is potential for a beetle epidemic in the 1250 acres of lodgepole type in the East DuNoir Creek drainage. Future aerial surveys should concentrate on this area of moderate risk and other moderate risk areas outside the SMU.

Efforts should be made to reduce the susceptibility of the currently infested lodgepole stands west of DuNoir Creek outside the SMU. This outbreak area poses the greatest threat to adjacent, moderately susceptible lodgepole pine stands throughout the DuNoir Creek Basin.

LITERATURE CITED

1. AMMAN, G. D. et al. 1977. Guidelines for reducing losses of lodgepole pine to the mountain pine beetle in unmanaged stands in the Rocky Mountains. USDA For. Serv. Gen. Tech. Rep. INT-37, 19 p. Intermt. For. and Range Exp. Sta., Ogden, UT.
2. USDA Forest Service. Undated. A proposal: Washakie Wilderness Addition. Shoshone National For. Wyo. Rocky Mountain Region. 8 p. (plus Appendix) (Unpublished)